What is Claimed is:

1. A surface shape recognition sensor comprising:

a plurality of capacitive detection elements formed from lower electrodes and a deformable plate-like upper electrode made of a metal, the lower electrodes being insulated and isolated from each other and stationarily laid out on a single plane of an interlevel dielectric formed on a semiconductor substrate, and the upper electrode being laid out above the lower electrodes at a predetermined interval and having a plurality of opening portions;

a support electrode laid out around the lower electrodes while being insulated and isolated from the lower electrodes, and formed to be higher than the lower electrodes to support the upper electrode;

a protective film formed on the upper electrode to close the opening portions; and

a plurality of projections laid out in a region of said protective film above said capacitive detection element.

2. A sensor according to claim 1, wherein said protective film and projections are integrally formed.

3. A sensor according to claim 1, wherein said

support electrode is made of a metal.

4. A sensor according to claim 1, wherein said sensor comprises an electrode dielectric film laid out on the lower electrode, and the upper electrode is laid out above said electrode dielectric film at a predetermined interval.

5. A sensor according to claim 4, wherein letting A be a moving amount of a central portion of the upper electrode when the upper electrode deforms at maximum within an elastic deformation range, the interval between the upper electrode and said electrode dielectric film is not more than A.

6. A sensor according to claim 4, wherein said electrode dielectric film is formed into substantially the same shape as that of the lower electrode and laid out to cover the lower electrode.

7. A surface shape recognition sensor comprising:

a plurality of capacitive detection elements formed from lower electrodes and a deformable plate-like upper electrode made of a metal, the lower electrodes being insulated and isolated from each other and stationarily laid out on a single plane of an interlevel

dielectric formed on a semiconductor substrate, and the upper electrode being laid out above the lower electrodes at a predetermined interval and having a plurality of opening portions;

a support electrode laid out around the lower electrodes while being insulated and isolated from the lower electrodes, and formed to be higher than the lower electrodes to support the upper electrode;

a protective film formed on the upper electrode to close the opening portions; and

a projection made of a metal and laid out in a region of said protective film above said capacitive detection element.

8. A sensor according to claim 7, wherein said projection is laid out in a region above the lower electrode.

9. A sensor according to claim 7, wherein a plurality of projections are laid out in the region above said capacitive detection element.

10. A sensor according to claim 7, wherein said support electrode is made of a metal.

11. A sensor according to claim 7, wherein said sensor comprises an electrode dielectric

film laid out on the lower electrode, and

the upper electrode is laid out above said electrode dielectric film at a predetermined interval.

12. A sensor according to claim 11, wherein letting A be a moving amount of a central portion of the upper electrode when the upper electrode deforms at maximum within an elastic deformation range, the interval between the upper electrode and said electrode dielectric film is not more than A.

13. A sensor according to claim 11, wherein said electrode dielectric film is formed into substantially the same shape as that of the lower electrode and laid out to cover the lower electrode.

14. A method of manufacturing a surface shape recognition sensor, comprising the steps of:

forming an interlevel dielectric on a semiconductor substrate;

forming a first metal film on the interlevel dielectric;

forming a first mask pattern having an opening portion in a predetermined region on the first metal film;

forming a first metal pattern on a surface of the first metal film exposed to a bottom portion of the

opening portion of the first mask pattern by plating;

after the first mask pattern is removed, forming a second mask pattern having an opening portion laid out around the first metal pattern on the first metal film and first metal pattern;

forming a second metal pattern thicker than the first metal pattern on the surface of the first metal film exposed to a bottom portion of the opening portion of the second mask pattern by plating;

after the second mask pattern is removed, etching and removing the first metal film using the first and second metal patterns as a mask to form a lower electrode formed from the first metal film and first metal pattern and a support electrode formed from the first metal film and second metal pattern;

forming a sacrificial film on the interlevel dielectric to cover the lower electrode while keeping an upper portion of the support electrode exposed;

forming an upper electrode having a plurality of opening portions on the sacrificial film and support electrode;

after the upper electrode is formed, selectively removing only the sacrificial film through the opening portions;

after the sacrificial film is removed, forming a protective film on the upper electrode;

forming a photosensitive resin film having

photosensitivity on the protective film; and

forming a plurality of projections in a region of the protective film above a capacitive detection element by exposing and developing a predetermined pattern on the photosensitive resin film,

wherein a plurality of capacitive detection elements each having the lower electrode and upper electrode are formed.

15. A method according to claim 14, wherein the protective film is formed on the upper electrode by transfer.

16. A method according to claim 15, wherein in the protective film transfer step, STP is used as a transfer method.

17. A method according to claim 15, wherein

the lower electrode formation step comprises the steps of forming the first metal film on the semiconductor substrate, forming a first patterned resist on the first metal film, forming the lower electrode in an opening portion of the first resist, and removing the first resist,

the support electrode formation step comprises the steps of forming a second patterned resist on the first metal film, forming the support electrode in an

opening portion of the second resist, removing the second resist, and etching the first metal film using the lower electrode and support electrode as a mask,

the upper electrode formation step comprises the steps of forming the sacrificial film on the lower electrode and support electrode, removing the sacrificial film on the support electrode to expose the support electrode, forming a second metal film on the support electrode and sacrificial film, forming a third patterned resist on the second metal film, forming the upper electrode in an opening portion of the third resist, removing the third resist, etching the second metal film using the upper electrode as a mask, and removing the sacrificial film,

the protective film transfer step comprises the step of transferring the protective film onto the upper electrode by STP,

the photosensitive resin film formation step comprises the step of applying the photosensitive resin film onto the protective film, and

the step of fabricating the photosensitive resin film into the projections comprises the steps of exposing part of the photosensitive resin film and executing development after exposure.

18. A method according to claim 14, wherein the sacrificial film is essentially formed from a polyimide

resin.

19. A method according to claim 14, wherein the sacrificial film is essentially formed from a polybenzoxazole precursor resin.

20. A method according to claim 14, wherein the sacrificial film is removed by heating the sacrificial film and simultaneously exposing the sacrificial film to an ozone ambient.

21. A method according to claim 14, wherein the lower electrode, support electrode, and upper electrode are essentially formed from gold.

22. A method according to claim 14, wherein

the upper electrode is formed on the sacrificial film and support electrode while separating the opening portions from a side wall of the support electrode, and

after the sacrificial film is removed, a liquid material is applied onto the upper electrode to form a coat, and the coat is hardened to form the protective film on the upper electrode to close the opening portions.

23. A method according to claim 22, wherein in

forming the coat, the coat is laid out on a force acting side of the substrate and hardened.

24. A method according to claim 23, wherein in forming the coat, the coat is laid out on a lower side of the substrate and hardened.

25. A method according to claim 22, wherein

letting t be a thickness of the coat in a region other than the opening portions in forming the coat,

a be a sectional area of the opening portion at a boundary between the opening portion and an external portion of a space formed between the upper electrode and the lower electrode,

b be a peripheral length of a section of the opening portion at a boundary between the space and the opening portion,

c be a volume in the opening portion,

d be the magnitude of surface tension, at the boundary between the space and the opening portion, between an opening portion inner wall and a portion of the coat that has entered the opening portion,

e be a density of the coat, and

g be a gravitational acceleration,

a relationship given by

$$(c + a \times t) \times e \times g \leqq b \times d$$

is satisfied.

26. A method according to claim 22, wherein the upper electrode is formed by plating gold on and around the sacrificial film, and the coat is formed by applying the liquid material formed from polyimide.

27. A method according to claim 26, wherein the coat is formed by applying the liquid material formed from polyimide having photosensitivity, and the protective film is formed in an opening portion region on the upper electrode to close the opening portions by removing a region of the coat other than a peripheral region of the opening portions by photolithography and hardening a remaining portion.

28. A method according to claim 14, wherein before the sacrificial film is formed, a first dielectric film that is lower than the support electrode and covers the lower electrode is formed on the lower electrode, and the first dielectric film is selectively removed to form an electrode dielectric film on the lower electrode.

29. A method according to claim 14, wherein after the first metal pattern is formed,

a first dielectric film is formed on the first metal pattern to cover the first metal pattern,

the first mask pattern is removed to form an electrode dielectric film on the first metal pattern, and then,

the second mask pattern is formed.

30. A method according to claim 14, wherein

after the first mask pattern is removed, a first dielectric film is formed on the first metal pattern to cover the first metal pattern,

the first dielectric film is selectively removed to form an electrode dielectric film on the first metal pattern, and

after the electrode dielectric film is formed, the second mask pattern is formed.

31. A method of manufacturing a surface shape recognition sensor, comprising the steps of:

forming an interlevel dielectric on a semiconductor substrate;

forming a first metal film on the interlevel dielectric;

forming a first mask pattern having an opening portion in a predetermined region on the first metal

film;

forming a first metal pattern on a surface of the first metal film exposed to a bottom portion of the opening portion of the first mask pattern by plating;

after the first mask pattern is removed, forming a second mask pattern having an opening portion laid out around the first metal pattern on the first metal film and first metal pattern;

forming a second metal pattern thicker than the first metal pattern on the surface of the first metal film exposed to a bottom portion of the opening portion of the second mask pattern by plating;

after the second mask pattern is removed, etching and removing the first metal film using the first and second metal patterns as a mask to form a lower electrode formed from the first metal film and first metal pattern and a support electrode formed from the first metal film and second metal pattern;

forming a sacrificial film on the interlevel dielectric to cover the lower electrode while keeping an upper portion of the support electrode exposed;

forming an upper electrode having a plurality of opening portions on the sacrificial film and support electrode;

after the upper electrode is formed, selectively removing only the sacrificial film through the opening portions;

after the sacrificial film is removed, forming a photosensitive resin film having photosensitivity on the upper electrode; and

simultaneously forming a protective film that covers the upper electrode and a plurality of projections laid out in a region of the protective film above a capacitive detection element by exposing and developing a predetermined pattern on the photosensitive resin film,

wherein a plurality of capacitive detection elements each having the lower electrode and upper electrode are formed.

32. A method according to claim 31, wherein the photosensitive resin film is formed on the upper electrode by transfer.

33. A method according to claim 32, wherein in the photosensitive resin film transfer step, STP is used as a transfer method.

34. A method according to claim 32, wherein

the lower electrode formation step comprises the steps of forming the first metal film on the semiconductor substrate, forming a first patterned resist on the first metal film, forming the lower electrode in an opening portion of the first resist, and

removing the first resist,

the support electrode formation step comprises the steps of forming a second patterned resist on the first metal film, forming the support electrode in an opening portion of the second resist, removing the second resist, and etching the first metal film using the lower electrode and support electrode as a mask,

the upper electrode formation step comprises the steps of forming the sacrificial film on the lower electrode and support electrode, removing the sacrificial film on the support electrode to expose the support electrode, forming a second metal film on the support electrode and sacrificial film, forming a third patterned resist on the second metal film, forming the upper electrode in an opening portion of the third resist, removing the third resist, etching the second metal film using the upper electrode as a mask, and removing the sacrificial film,

the photosensitive resin film transfer step comprises the step of transferring the photosensitive resin film onto the upper electrode by STP, and

the step of forming the protective film and the plurality of projections on the protective film comprises the steps of exposing part of the photosensitive resin film and executing development after exposure.

35. A method according to claim 31, wherein the sacrificial film is essentially formed from a polyimide resin.

36. A method according to claim 31, wherein the sacrificial film is essentially formed from a polybenzoxazole precursor resin.

37. A method according to claim 31, wherein the sacrificial film is removed by heating the sacrificial film and simultaneously exposing the sacrificial film to an ozone ambient.

38. A method according to claim 31, wherein the lower electrode, support electrode, and upper electrode are essentially formed from gold.

39. A method according to claim 31, wherein before the sacrificial film is formed,

a first dielectric film that is lower than the support electrode and covers the lower electrode is formed on the lower electrode, and

the first dielectric film is selectively removed to form an electrode dielectric film on the lower electrode.

40. A method according to claim 31, wherein

after the first metal pattern is formed, a first dielectric film is formed on the first metal pattern to cover the first metal pattern, the first mask pattern is removed to form an electrode dielectric film on the first metal pattern, and then, the second mask pattern is formed.

41. A method according to claim 31, wherein after the first mask pattern is removed, a first dielectric film is formed on the first metal pattern to cover the first metal pattern, the first dielectric film is selectively removed to form an electrode dielectric film on the first metal pattern, and after the electrode dielectric film is formed, the second mask pattern is formed.

42. A method of manufacturing a surface shape recognition sensor, comprising the steps of: forming an interlevel dielectric on a semiconductor substrate; forming a first metal film on the interlevel dielectric; forming a first mask pattern having an opening portion in a predetermined region on the first metal film;

forming a first metal pattern on a surface of the first metal film exposed to a bottom portion of the opening portion of the first mask pattern by plating;

after the first mask pattern is removed, forming a second mask pattern having an opening portion laid out around the first metal pattern on the first metal film and first metal pattern;

forming a second metal pattern thicker than the first metal pattern on the surface of the first metal film exposed to a bottom portion of the opening portion of the second mask pattern by plating;

after the second mask pattern is removed, etching and removing the first metal film using the first and second metal patterns as a mask to form a lower electrode formed from the first metal film and first metal pattern and a support electrode formed from the first metal film and second metal pattern;

forming a sacrificial film on the interlevel dielectric to cover the lower electrode while keeping an upper portion of the support electrode exposed;

forming an upper electrode having a plurality of opening portions on the sacrificial film and support electrode;

after the upper electrode is formed, selectively removing only the sacrificial film through the opening portions;

after the sacrificial film is removed, forming

a protective film on the upper electrode;

forming a second metal film on the protective film;

forming a third mask pattern having an opening portion in a predetermined region on the second metal film;

forming a third metal pattern on a surface of the second metal film exposed to a bottom portion of the opening portion of the third mask pattern by plating; and

after the third mask pattern is removed, etching and removing the second metal film using the third metal pattern as a mask to form a projection formed from the second metal film and third metal pattern

wherein a plurality of capacitive detection elements each having the lower electrode and upper electrode are formed.

43. A method according to claim 42, wherein the protective film is formed on the upper electrode by transfer.

44. A method according to claim 43, wherein in the protective film transfer step, STP is used as a transfer method.

45. A method according to claim 42, wherein the sacrificial film is essentially formed from a polyimide resin.

46. A method according to claim 42, wherein the sacrificial film is essentially formed from a polybenzoxazole precursor resin.

47. A method according to claim 42, wherein the sacrificial film is removed by heating the sacrificial film and simultaneously exposing the sacrificial film to an ozone ambient.

48. A method according to claim 42, wherein the lower electrode, support electrode, and upper electrode are essentially formed from gold.

49. A method according to claim 42, wherein

the upper electrode is formed on the sacrificial film and support electrode while separating the opening portions from a side wall of the support electrode, and

after the sacrificial film is removed, a liquid material is applied onto the upper electrode to form a coat, and the coat is hardened to form the protective film on the upper electrode to close the opening portions.

50. A method according to claim 49, wherein in forming the coat, the coat is laid out on a force acting side of the substrate and hardened.

51. A method according to claim 50, wherein in forming the coat, the coat is laid out on a lower side of the substrate and hardened.

52. A method according to claim 49, wherein

letting t be a thickness of the coat in a region other than the opening portions in forming the coat,

a be a sectional area of the opening portion at a boundary between the opening portion and an external portion of a space formed between the upper electrode and the lower electrode,

b be a peripheral length of a section of the opening portion at a boundary between the space and the opening portion,

c be a volume in the opening portion,

d be the magnitude of surface tension, at the boundary between the space and the opening portion, between an opening portion inner wall and a portion of the coat that has entered the opening portion,

e be a density of the coat, and

g be a gravitational acceleration,

a relationship given by

$$(c + a \times t) \times e \times g \leqq b \times d$$

is satisfied.

53. A method according to claim 49, wherein the upper electrode is formed by plating gold on and around the sacrificial film, and the coat is formed by applying the liquid material formed from polyimide.

54. A method according to claim 53, wherein the coat is formed by applying the liquid material formed from polyimide having photosensitivity, and the protective film is formed in an opening portion region on the upper electrode to close the opening portions by removing a region of the coat other than a peripheral region of the opening portions by photolithography and hardening a remaining portion.

55. A method according to claim 42, wherein before the sacrificial film is formed, a first dielectric film that is lower than the support electrode and covers the lower electrode is formed on the lower electrode, and the first dielectric film is selectively removed to form an electrode dielectric film on the

lower electrode.

56. A method according to claim 42, wherein after the first metal pattern is formed,

a first dielectric film is formed on the first metal pattern to cover the first metal pattern,

the first mask pattern is removed to form an electrode dielectric film on the first metal pattern, and then,

the second mask pattern is formed.

57. A method according to claim 42, wherein

after the first mask pattern is removed, a first dielectric film is formed on the first metal pattern to cover the first metal pattern,

the first dielectric film is selectively removed to form an electrode dielectric film on the first metal pattern, and

after the electrode dielectric film is formed, the second mask pattern is formed.